a raw material reforming reaction unit for steam-reforming a raw material and producing a reformed gas containing hydrogen as a principal component;

a shift reaction unit for decreasing CO contained in the reformed gas, that was produced in said raw material reforming unit, by water-gas-shift reaction;

a CO oxidation unit for further decreasing CO contained in the resultant reformed gas, that was treated in said shift reaction unit, by oxidation; and

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said reforming reaction unit and said shift reaction unit containing different catalysts, said shift reaction unit and said CO oxidation unit being directly heated by heat transfer from the heat source of said raw material reforming unit, said CO oxidation unit being positioned outside said reforming reaction unit, and said reforming reaction unit being directly heated by said combustion unit so that the temperature in said reforming reaction unit is controlled in the range of 400 to 1000°C, said shift reaction unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said shift reaction unit is controlled in the range of 200 to 350°C, said CO oxidation unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said CO oxidation unit is controlled in the range of 100 to 250°C.

REMARKS

Upon entry of this amendment, claims 1-7, 10-15, 18-21, 29 and 30 will be amended, whereby claims 1-30 will remain pending. Claims 1, 12, 18, 20 and 30 are independent claims.

Reconsideration and allowance of the application are respectfully requested.

RESPONSE TO FORMAL MATTERS

Applicants express appreciation for the acknowledgment of the claim of priority under 35 U.S.C. 119 as well as receipt of all of the certified copies which were received in this national stage application from the International Bureau.

Applicants also express appreciation for the inclusion in the Office Action of the initialed copies of the Forms PTO-1449 submitted with the Information Disclosure Statement, the Supplemental Information Disclosure Statement and the Second Supplemental Information Disclosure Statement, whereby the Examiner's consideration of the disclosure statements is of record.

With respect to the initialed forms, Applicants further express their appreciation for the correction of the citation to JP 7-126001, which included a typographical error in the disclosure statement. It is further noted that this document is cited on the Form PTO-892 attached to the Office Action.

Still further, it is noted that the Patent Abstracts of Japan, Vol. 1996, No. 08, August 30, 1996 is not initialed. It is clear that this lack of initialing is inadvertent, because the Office Action is silent with respect to any indication as to a lack of initialing. Moreover, the U.S. patent and Japanese family members, i.e., U.S. Patent No. 5,658,681 and JP-A-8-106914, have been initialed, so that it is clear that the Examiner has considered this abstract. However, so that the face of the patent accurately reflects the Examiner's consideration of this abstract, it is respectfully requested that the Examiner include a completely initialed form with the next communication from the Patent and Trademark Office. For the convenience of the Examiner, another copy of the form is enclosed.

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It is noted that the Form PTO-948 attached to the Office Action objects to the drawings indicating that the English alphabet is not used. In response, it is noted that a literal English translation of the International Application, including the drawings, was filed February 8, 1999. These drawings include a translation of the Japanese into the English alphabet, whereby this ground of objection is without basis, and should be withdrawn.

Accordingly, withdrawal of the objection to the drawings is respectfully requested, with an indication that the formal drawings submitted with the literal English translation are acceptable.

In response to the objection to the disclosure, the specification has been reviewed and revised to be more in conformance with idiomatic English, whereby this ground of objection should be withdrawn.

Response to Objections to Claims 4 and 30

In response to the objections to claims 4 and 30, it is noted that claim 4 has been amended to change "with" to ---within--- and claim 30 has been amended to correct the indicated typographical error, whereby these grounds of objection should be withdrawn.

Response to Rejection of Claims 1-6 and 30 Under 35 U.S.C. 112, Second Paragraph

In response to the rejection of claims 1-6 and 30 under 35 U.S.C. 112, second paragraph, Applicants respectfully submit the following.

In this ground of rejection, it is contended that the claims are indefinite in the use of certain terminology. In response, Applicants respectfully submit that the claims as originally presented are definite. However, in order to advance prosecution of this application, the claims have been

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amended to even more definitely recite Applicants' invention taking into consideration the Examiner's comments and suggestions.

Moreover, Applicants respectfully direct the Examiner's attention to page 30 of the specification with respect to heat conductive material 19, and page 32 line 20 et seq. for disclosure regarding the first and second ducts. Applicants respectfully submit that one having ordinary skill in the are would readily understand the claim recitations regarding this subject matter, whereby the rejection of record should be withdrawn.

Still further, Applicants note that claim 3 clearly recites that the raw material reforming unit comprises a generally cylindrical combustion chamber as the heat source and a reforming reaction unit for steam-reforming the raw material to produce the reformed gas containing hydrogen as a principal component.

Applicants therefore respectfully request that the rejection of the claims under 35 U.S.C. 112, second paragraph, be withdrawn, with allowance of all the pending claims.

Response to Indication of Allowable Subject Matter and the Rejection over MURRAY et al. In View Of TANIZAKI

In response to the indication of allowability of claims 12-18 and 20-23, and the rejection of claims 1-11, 19 and 24-30 under 35 U.S.C. 103(a) as being unpatentable over MURRAY et al. (hereinafter "MURRAY"), EP 0 199 878, in view of TANIZAKI, JP 07-126001 A, Applicants respectfully submit the following.

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Applicants express appreciation for the indication of allowability of claims 12-18 and 20-23, and by the present amendment have presented claims 12, 18 and 20 in independent form, whereby these claims, and the claims depending therefrom, i.e., claims 13-17, 19 and 21-23 should be in condition for allowance.

Moreover, in response to the rejection, Applicants respectfully submit that the prior art does not teach or suggest Applicants' invention as disclosed and claimed. In this regard, it is noted that Applicants' independent claim 1 is directed to a reforming apparatus comprising an integrated structure of three separate units, comprising:

a raw material reforming unit for steam-reforming a raw material to be reformed and producing a reformed gas containing hydrogen as a principal component, including a heat source that generates heat by combustion of a fuel gas, operable to directly obtain heat for the steam reformation reaction from said heat source;

a shift reaction unit for decreasing, by water-gas-shift reaction, CO contained in the reformed gas produced in said raw material reforming unit; and

a CO oxidation unit for further decreasing, by oxidation, CO contained in reformed gas treated in said shift reaction unit; and

said raw material reforming unit and said shift reaction unit contain different catalysts, and said shift reaction unit and said CO oxidation unit being arranged in a manner that said shift reaction unit and said CO oxidation unit can be indirectly heated by heat transfer from the heat source of said raw material reforming unit, and further said CO oxidation unit including an outside surface, and being arranged to obtain atmospheric cooling of the outside surface.

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Still further, Applicants' independent claim 30 is directed to a reforming apparatus comprising an integrated structure of four separate units, which comprises:

a combustion unit for generating heat by combustion of a fuel gas;

a raw material reforming reaction unit for steam-reforming a raw material and producing a reformed gas containing hydrogen as a principal component;

a shift reaction unit for decreasing CO contained in the reformed gas, that was produced in said raw material reforming unit, by water-gas-shift reaction; and

a CO oxidation unit for further decreasing CO contained in the resultant reformed gas, that was treated in said shift reaction unit, by oxidation,

at least two units, said reforming reaction unit and said shift reaction unit containing different catalysts, said shift reaction unit and said CO oxidation unit being directly heated by heat transfer from the heat source of said raw material reforming unit, said CO oxidation unit being positioned outside said reforming reaction unit, and said reforming reaction unit being directly heated by said combustion unit so that the temperature in said reforming reaction unit is controlled in the range of 400 to 1000°C, said shift reaction unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said shift reaction unit is controlled in the range of 200 to 350°C, said CO oxidation unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said CO oxidation unit is controlled in the range of 100 to 250°C.

In contrast to Applicants' disclosed and claimed invention, it is noted that the rejection utilizes the disclosure of TANIZAKI in order to modify the hydrocarbon fuel reformer of MURRAY to include a CO oxidation unit in an attempt to arrive at the structure recited in Applicants' claims, including the CO oxidation unit and its placement with respect to the remainder of the structure as

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recited in Applicants' claims. However, Applicants respectfully submit that one having ordinary skill in the art would not have been motivated to modify the hydrocarbon fuel reformer of MURRAY in the manner asserted in the rejection. In particular, MURRAY discloses, at page 11, lines 30-37, that although the entire shift reaction cannot be performed within shift reaction chamber 60, a sufficient portion of the reaction can be achieved therein that the size of the external shift reaction device 104 can be substantially reduced. MURRAY further discloses that since about 30 to 40% of the shift reaction is accomplished within shift reaction chamber 60, the external shift reactor can be correspondingly reduced in size.

From the above, it is apparent that MURRAY discloses that the shift reactor is at least partially externally positioned from the main reactor. Therefore, even if one were to add a CO oxidation unit to the hydrocarbon fuel reformer of MURRAY, it would not be situated in a manner as recited in Applicants' claims, but would be positioned at a location after shift reactor 104 in MURRAY. Thus, whether is not it would have been obvious to combine the disclosures of MURRAY and TANIZAKI, the instantly claimed invention would not be arrive at.

Still further, attention is directed to Applicants' specification, at page 14, lines 7 to 21, wherein it is disclosed that the CO oxidation unit is heated to the range of 100 to 250°C while the reforming reaction unit is heated to the range of 400 to 1000°C, so that the temperature difference between them is so large that the temperature control thereof becomes difficult to accomplish. Therefore, Applicants' structure includes that the shift reaction unit and the CO oxidation unit are arranged in a manner that the shift reaction unit and the CO oxidation unit can be indirectly heated by heat transfer from the heat source of the raw material reforming unit. Moreover, the CO oxidation unit can be arranged so as to get cooling of the outside surface by the atmosphere.

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Additionally, each of the dependent claims is patentable over the prior art of record in view of the fact that each of these dependent claims includes the limitations of the claims from which they depend. Moreover, each of the dependent claims is patentable over the prior art of record because it would not have been obvious to one having ordinary skill in the art to incorporate such dependent claim features into the invention as more broadly recited in the claims from which they depend. In view of the fact that a prima facie case of obviousness has not been established for independent claim 1, for the sake of brevity, the specific features of each of these dependent claims is not being individually argued at the present time except for the statement that each of these claims is patentable over the prior art for the combination of features recited therein.

Accordingly, the rejections of record should be withdrawn as improper, and all of the claims should be indicated as allowable.

CONCLUSION

In view of the foregoing, the Examiner is respectfully requested to reconsider and withdraw the rejection of record, and allow each of the pending claims.

Applicant therefore respectfully requests that an early indication of allowance of the application be indicated by the mailing of the Notices of Allowance and Allowability.

Any amendments to the claims which have been made in this amendment, and which have not been specifically noted to overcome a rejection based upon the prior art, should be considered to have been made for a purpose unrelated to patentability, and no estoppel should be deemed attached thereto.

Should the Examiner have any questions regarding this Response, the this application, the Examiner is invited to contact the undersigned at the below-listed telephone number.

Respectfully submitted,
Hitoshi KUDO et al.

Arnold Turk
Reg. No. 33,094

November 20, 2000
GREENBLUM & BERNSTEIN, P.L.C.
1941 Roland Clarke Place
Reston, VA 20191
(703) 716-1191

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MARKED UP COPY OF CLAIMS 1-7, 10-15, 18-21, 29 and 30

1. (Twice Amended) A reforming apparatus comprising an integrated structure of three separate units, [which comprises] comprising:

a raw material reforming unit for steam-reforming a raw material to be reformed and producing a reformed gas containing hydrogen as a principal component, including a heat source that generates heat by combustion of a fuel gas, operable to directly obtain heat for the steam reformation reaction from said heat source;

a shift reaction unit for decreasing, by water-gas-shift reaction, CO contained in the reformed gas [, that was] produced in said raw material reforming unit[, by water-gas-shift reaction]; and

a CO oxidation unit for further [degreasing] decreasing, by oxidation, CO contained in [the resultant] reformed gas [, that was] treated in said shift reaction unit [, by oxidation,]; and

[at least two units,] said raw material reforming unit and said shift reaction unit contain different catalysts, and said shift reaction unit and said CO oxidation unit being arranged in a manner that said shift reaction unit and said CO oxidation unit can be indirectly heated by heat transfer from the heat source of said raw material reforming unit, and further said CO oxidation unit including an outside surface, and being arranged [in a position outside said raw material unit] to obtain atmospheric cooling of the outside surface.

2. (Amended) The reforming apparatus according to claim 1, wherein said raw material reforming unit, said shift reaction unit and said CO oxidization unit are concentrically arranged relative to each other with [at least] said CO oxidization unit placed on an outer peripheral side of the reforming apparatus.

3. (Amended) The reforming apparatus according to claim 2, wherein said raw material reforming unit comprises a generally cylindrical combustion chamber as the heat source and a reforming reaction unit for steam-reforming the raw material to produce the reformed gas [,] containing hydrogen as a principal component, said reforming reaction unit, said shift reaction unit and said CO oxidation unit are concentrically arranged relative to said combustion chamber.

4. (Amended) The reforming apparatus according to claim 3, wherein said reforming reaction unit is concentrically accommodated [with] within said combustion chamber.

5. (Amended) The reforming apparatus according to claim 3, wherein said reforming reaction unit is [arranged around] positioned outside said combustion chamber in contact therewith.

6. (Twice Amended) The reforming apparatus according to claim [5] 3, said combustion chamber comprising a center, and further comprising an incombustible core arranged at the center of said combustion chamber.

7. (Twice Amended) The reforming apparatus according to claim 3, wherein both of said shift reaction unit and said CO oxidation unit are [arranged around] positioned outside said reforming reaction unit.

10. (Twice Amended) The reforming apparatus according to claim 7, wherein said shift reaction unit is arranged on a side adjacent to a high temperature zone of said reforming unit and said CO oxidation unit is arranged on a side adjacent a low temperature side of said reforming reaction unit, so as to be in conformity to a temperature distribution within said reforming reaction unit.

11. (Twice Amended) The reforming apparatus according to claim 1, wherein each of said shift reaction unit and said CO oxidation unit [are respectively] is arranged in a position which is heated by a burned exhaust gas from said heat source of said raw material reforming unit.

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12. (Twice Amended) A reforming apparatus comprising an integrated structure of three separate units, comprising:

a raw material reforming unit for steam-reforming a raw material to be reformed and producing a reformed gas containing hydrogen as a principal component, including a heat source that generates heat by combustion of a fuel gas, operable to directly obtain heat for the steam reformation reaction from said heat source;

a shift reaction unit for decreasing, by water-gas-shift reaction, CO contained in the reformed gas produced in said raw material reforming unit; and

a CO oxidation unit for further decreasing, by oxidation, CO contained in reformed gas treated in said shift reaction unit;

said raw material reforming unit and said shift reaction unit contain different catalysts, and said shift reaction unit and said CO oxidation unit being arranged in a manner that said shift reaction unit and said CO oxidation unit can be indirectly heated by heat transfer from the heat source of said raw material reforming unit, and further said CO oxidation unit being arranged in a position outside said raw material unit;

said raw material reforming unit comprising a generally cylindrical combustion chamber as the heat source and a reforming reaction unit for steam-reforming the raw material to produce the reformed gas containing hydrogen as a principal component, said reforming reaction unit, said shift reaction unit and said CO oxidation unit are concentrically arranged relative to said combustion chamber; and

[The apparatus according to claim 3,] further comprising an exhaust chamber, in which a burned exhaust gas from said combustion chamber directly flows, wherein said exhaust chamber is

positioned adjacent to and coaxially above said combustion chamber, said shift reaction unit being [arranged around] positioned outside said exhaust chamber, said CO oxidation unit being [arranged around] positioned outside said shift reaction unit.

13. (Amended) The reforming apparatus according to claim 12, further comprising an air intake for introducing fresh air [in between] inbetween said combustion chamber and said exhaust chamber.

14. (Twice Amended) The reforming apparatus according to claim 12, further comprising a secondary heating [means] element for heating said exhaust chamber.

15. (Twice Amended) The reforming apparatus according to claim 12, further comprising an exhaust vent for discharging the burned exhaust gas in said exhaust chamber to the outside, a shutter [means] for selectively opening and closing said exhaust vent, a first duct which is separated from said exhaust chamber and interposed between said shift reaction unit and said CO oxidation unit, and a second duct which is fluid-connected with said first duct and [arranged around] positioned outside said CO oxidation unit.

18. (Twice Amended) A reforming apparatus comprising an integrated structure of three separate units, comprising:

a raw material reforming unit for steam-reforming a raw material to be reformed and producing a reformed gas containing hydrogen as a principal component, including a heat source that generates heat by combustion of a fuel gas, operable to directly obtain heat for the steam reformation reaction from said heat source;

a shift reaction unit for decreasing, by water-gas-shift reaction, CO contained in the reformed gas produced in said raw material reforming unit; and

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a CO oxidation unit for further decreasing, by oxidation, CO contained in reformed gas treated in said shift reaction unit;

said raw material reforming unit and said shift reaction unit contain different catalysts, and said shift reaction unit and said CO oxidation unit being arranged in a manner that said shift reaction unit and said CO oxidation unit can be indirectly heated by heat transfer from the heat source of said raw material reforming unit, and further said CO oxidation unit being arranged in a position outside said raw material unit;

said raw material reforming unit comprising a generally cylindrical combustion chamber as the heat source and a reforming reaction unit for steam-reforming the raw material to produce the reformed gas containing hydrogen as a principal component, said reforming reaction unit, said shift reaction unit and said CO oxidation unit are concentrically arranged relative to said combustion chamber; and

[The reforming apparatus according to claim 3, wherein] at least one of said reforming reaction unit, said shift reaction unit and said CO oxidation unit is provided on a surface thereof with a heat transfer material having a higher heat conductivity than that of a material [composing] of which said surface is composed.

19. (Twice Amended) The reforming apparatus according to claim 3, wherein said CO oxidation unit [has] includes fins for heat dissipation on an outer surface thereof [provided with fins for heat dissipation].

20. (Twice Amended) A reforming apparatus comprising an integrated structure of three separate units, comprising:

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a raw material reforming unit for steam-reforming a raw material to be reformed and producing a reformed gas containing hydrogen as a principal component, including a heat source that generates heat by combustion of a fuel gas, operable to directly obtain heat for the steam reformation reaction from said heat source;

a shift reaction unit for decreasing, by water-gas-shift reaction, CO contained in the reformed gas produced in said raw material reforming unit; and

a CO oxidation unit for further decreasing, by oxidation, CO contained in reformed gas treated in said shift reaction unit;

said raw material reforming unit and said shift reaction unit contain different catalysts, and said shift reaction unit and said CO oxidation unit being arranged in a manner that said shift reaction unit and said CO oxidation unit can be indirectly heated by heat transfer from the heat source of said raw material reforming unit, and further said CO oxidation unit being arranged in a position outside said raw material unit;

said raw material reforming unit comprising a generally cylindrical combustion chamber as the heat source and a reforming reaction unit for steam-reforming the raw material to produce the reformed gas containing hydrogen as a principal component, said reforming reaction unit, said shift reaction unit and said CO oxidation unit are concentrically arranged relative to said combustion chamber; and

[The reforming apparatus according to claim 3,] further comprising a main exhaust chamber in which a burned exhaust gas from said combustion chamber directly flows, a main exhaust vent for directly discharging the burned exhaust gas in said main exhaust chamber to the outside, a shutter [means] for selectively opening and closing said main exhaust vent, a first duct which is separated

from said main exhaust chamber and fluid-connected thereto and is [arranged around] positioned outside said main exhaust chamber, and a second duct which is fluid-connected with said first duct and [arranged around] positioned outside said first duct, said shift reaction unit being placed in said first duct, said CO oxidation unit being placed in said second duct.

21. (Amended) The reforming apparatus according to claim 20, further comprising an exhaust sub-vent for discharging a burned exhaust gas within said first duct to the outside, and a shutter [means] for selectively opening and closing said exhaust sub-vent.

29. (Twice Amended) The reforming apparatus according to claim 1, further comprising a combustion catalyst held in said heat source and a [preheating means] preheater for preheating the combustion catalyst, wherein the heat source of said raw material reforming unit generates heat by catalytic combustion.

30. (Twice Amended) A reforming apparatus comprising an integrated structure of four separate units, which comprises:

a combustion unit for generating heat by combustion of a fuel gas;

a raw material reforming reaction unit for steam-reforming a raw material and producing a reformed gas containing hydrogen as a principal component;

a shift reaction unit for decreasing CO contained in the reformed gas, that was produced in said raw material reforming unit, by water-gas-shift reaction; [and]

a CO oxidation unit for further [degreasing] decreasing CO contained in the resultant reformed gas, that was treated in said shift reaction unit, by oxidation[,] ; and

[at least two units,] said reforming reaction unit and said shift reaction unit containing different catalysts, said shift reaction unit and said CO oxidation unit being directly heated by heat

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transfer from the heat source of said raw material reforming unit, said CO oxidation unit being [arranged around] positioned outside said reforming reaction unit, and said reforming reaction unit being directly heated by said combustion unit so that the temperature in said reforming reaction unit is controlled in the range of 400 to 1000°C, said shift reaction unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said shift reaction unit is controlled in the range of 200 to 350°C, said CO oxidation unit being indirectly heated by heat transfer from said combustion unit so that the temperature in said CO oxidation unit is controlled in the range of 100 to 250°C.

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MARKED-UP COPY OF CHANGES TO SPECIFICATION

Please replace the paragraph appearing at page 1, line 14 to page 2, line 2 with the following paragraph:

Conventionally, a reforming apparatus, that performs steam reformation of a raw material to be reformed and produced a reformed gas containing hydrogen as a principal component, has been known. One of applications of the reformed gas is a fuel utilizable to generate electricity in a fuel cell but, in this case, since the carbon monoxide is poisonous to electrodes of the fuel cell, it is desired that the content of carbon monoxide (CO) in the reformed gas should be removed to a level of 100 ppm or less. Therefore, CO is removed from the reformed gas by employing, after the step of steam-reforming the raw material, a step of [degreasing] <u>decreasing</u> the concentration of CO in the resultant reformed gas by water-gas-shift reaction and a step of further [degreasing] <u>decreasing</u> the concentration of CO in the resultant reformed gas by selectively oxidizing CO, as disclosed in JPA HEI 5-251,104. However, conventionally, since the three reaction steps mentioned above [are] <u>is</u> performed separately in respective apparatuses, a reforming system as a whole tends to be [balky] <u>bulky</u>. In addition, since heat sources for providing [with] heat of reaction are needed separately in [respectively] <u>respective</u> reaction steps, [the] heat loss is large. Therefore, in the conventional reforming apparatus, it has been desired to lower the heat loss and to reduce the size.

Please replace the paragraph appearing at page 2, line 16 to page 4, line 1 with the following paragraph:

However, the prior art reforming apparatus involves a problem that <u>the temperature in</u> each of the reaction [unit] <u>units</u> can not be suitably controlled [temperature]. That is, it is known that [a]

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catalytic reactions takes place in all of the above three reaction units and that there is a range of reactive temperature required in each of the reactions that take place respectively in the three reaction units. The range of reactive temperature of steam reforming reaction, which varies according to the kind of the raw material, for example, is about 400 to 1000°C, preferably, 600 to 900°C, when the raw material is a hydrocarbon such as butane, and also 250 to 400°C when the raw material is methanol. On the other hand, [The] the range of reactive temperature required by the water-gas-shift reaction or the CO selective oxidation reaction does not vary so much according to the kind of the raw material, and the range of reaction temperature required by the water-gas-shift reaction is generally about 200 to 350°C and, preferably, 220 to 300°C, and that required by the CO selective oxidation reaction is generally about 100 to 250°C, preferably, 120 to 180°C. In general, the range of reactive temperature decreases in the order of that in the reforming reaction unit, that in the shift reaction unit, that in the CO oxidation unit. Therefore, it is necessary to control the temperature in each reaction unit so as to be in the above respective range of reactive temperature. However, the reforming reaction unit and the shift reaction unit in the above prior art reforming apparatus do not separate from each other, but continued unitarily, that is, they are functionally distinguished in that the form of reaction changes from the steam reforming reaction onto the water-gas-shift reaction as the temperature of the reformed gas lowers. For this reason, even though this reforming apparatus is capable of effectively performing the steam reformation of methanol which requires a small difference between the reforming temperature and the shift reaction temperature, the steam reformation of hydrocarbons tends to exhibit a temperature diverting from the required temperature range during a transit from the reforming unit to the shift reaction unit and, therefore, a problem would arise with the hydrocarbon such as butane of which reactive temperature range during the

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steam reforming reaction is high. Also, since the prior art reforming apparatus has a laminated structure that the reformation treating layers and the combustion gas flow path layers alternate sidewise, the same reaction units tend to have a varying temperature depending on the position in the laminated structure, and specifically, a temperature difference between a position near to the outer periphery of the apparatus and a center position of the apparatus tends to be [considerable] <u>considerably</u> large because the position near to the outer periphery of the apparatus is cooled by the air outside. Particularly, this varying temperature becomes problematic in the CO oxidation unit which has a narrow range of reactive temperature. Thus, when it occurs that some of the reaction units have a temperature diverting from the required temperature range, there is a fear that the hydrogen content in the resultant reformed gas lowers and the CO concentration would not be sufficiently lowered.

Please replace the paragraph appearing at page 10, lines 5 to 10, with the following paragraph:

It is preferable to employ [a] <u>an</u> air intake for introducing the fresh air into the second duct (Fig. 22). The use of this air intake makes it possible to cool only the burned exhaust gas then flowing through the second duct with the fresh air introduced into the second duct when the exhaust vent is closed by the shutter means, and therefore the CO oxidation unit can be more preferably controlled as to its temperature.

Please replace the paragraph appearing at page 17, lines 14 to 24, with the following paragraph:

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The reforming apparatus according to the first embodiment comprises, as shown in Fig. 1, a generally cylindrical combustion chamber 1 which serves as a heat source, surrounded by a reforming reaction unit 2 for [reforming a] steam-reforming a [reforming] raw material to generate a reformed gas containing hydrogen as a principal component. The reforming reaction unit 2 is in turn surrounded by a shift reaction unit 3 for reducing CO, contained in the reformed gas generated by the reforming reaction unit 2, by the water shift reaction and a CO oxidizing unit 4 for oxidizing the CO component, contained in the reformed gas after treatment in the shift reaction unit 3, to thereby further reduce the CO component. The reforming reaction unit 2, the shift reaction unit 3 and the CO oxidizing units 4 are separate units and arranged in coaxial relation to each other.

Please replace the paragraph appearing at page 30, lines 3-25, with the following paragraph:

The reforming apparatus according to a fourteenth embodiment will be described hereinafter. This reforming apparatus is of a structure, as shown in Fig. [13] 15, in which in the eleventh embodiment a heat conductive material 19 having a higher heat conductivity than that exhibited by the material forming a surface of each of the reforming reaction unit 2, the shift reaction unit 3 and the CO oxidizing unit 4 is disposed on such surface. This heat conductive material 19 serves to uniformalize the distribution of temperature in each of the reaction units with respect to the direction of flow of the gas. In other words, [In] in each of the reaction units, the temperature difference tends to be created in a direction conforming to the direction of flow of the gas in such a way that, for example, since in the reforming reaction unit 2 an endothermic reaction takes place, the temperature on [an] a leeward side tends to lower whereas since in the shift reaction unit 4 and the CO oxidizing unit 4 [a] an exothermic reaction takes place, the temperature on a windward side tends to increase.

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The heat conductive material 19 provided on the respective surfaces of the reaction units serves to uniformalize this temperature difference by heat conduction. The surface material of the reaction units, although sufficient if it has a high heat conductivity, is used in the form of, for example, stainless steel in view of the fact that [a] corrosion resistance and [a] durability are required as well and, in contrast thereto, the heat conductive material 19 is employed in the form of copper or aluminum. Although they are inferior in that the heat resistance and the strength are lower than those of the stainless steel, they are excellent in heat conductivity.

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